TURTLE COVE (PO-10)
State-Funded

I. INTRODUCTION

I.1. Project Description

The Turtle Cove Shoreline Protection Project is a state-funded project which was constructed between September 1993 and July 1994. It was proposed, but not selected for funding through CWPPRA on the first Priority Project List. The project is located in the Manchac Wildlife Management Area in northern St. John the Baptist Parish between Lakes Maurepas and Pontchartrain (figure 1). The project was designed to protect a narrow strip of shoreline that separates Lake Pontchartrain from an area known as The Prairie. The Prairie is a 320 ha (800 acre) expanse consisting mostly of shallow open water with some flotant marsh bordered by fresh marsh. Within The Prairie, *Myriophyllum spicata* (Eurasian watermilfoil) and *Ceratophyllum demersum* (coontail grass) cover the open water. The fresh marsh along the waters edge is dominated by *Sagittaria lancifolia* (bull tongue) and *Taxodium disticum* (cypress trees). Historically the cypress swamp west of The Prairie has had extensive logging. Abandoned logging tracts extending out from canal terminal ends now scar this fresh marsh.

The majority of the northwest Lake Pontchartrain shoreline contains Maurepas series soils which consist of a woody organic surface layer often extending to a depth of 75 cm (29.5 in). Soils in the area of “The Prairie” and Turtle Cove, however, consist of Allemands-Carlin peat which are described as highly erodible organic peat and muck soils (USDA 1972). Lake Pontchartrain has an estimated shoreline erosion rate of 4 m (13.12 ft) per year (Louisiana Department of Transportation and Development [LDOTD] 1978). The width of shoreline at Turtle Cove ranges from 20 to 60 m (65.6 – 196.8 ft). Without this project, this strip of land will be lost within 10 years; however, a single storm event could breach the area at any time. With the loss of this hydrologic barrier, high rates of flow will cause severe erosion and loss of vegetation within The Prairie.

A 500 m (1640 ft) rock gabion breakwater has been constructed across the mouth of Turtle Cove. The goal of the project was to slow the erosion of the shoreline, protect 320 ha (800 acres) of fresh marsh habitat, and create emergent wetland through the accretion of sediment between the rock gabion and the shoreline.

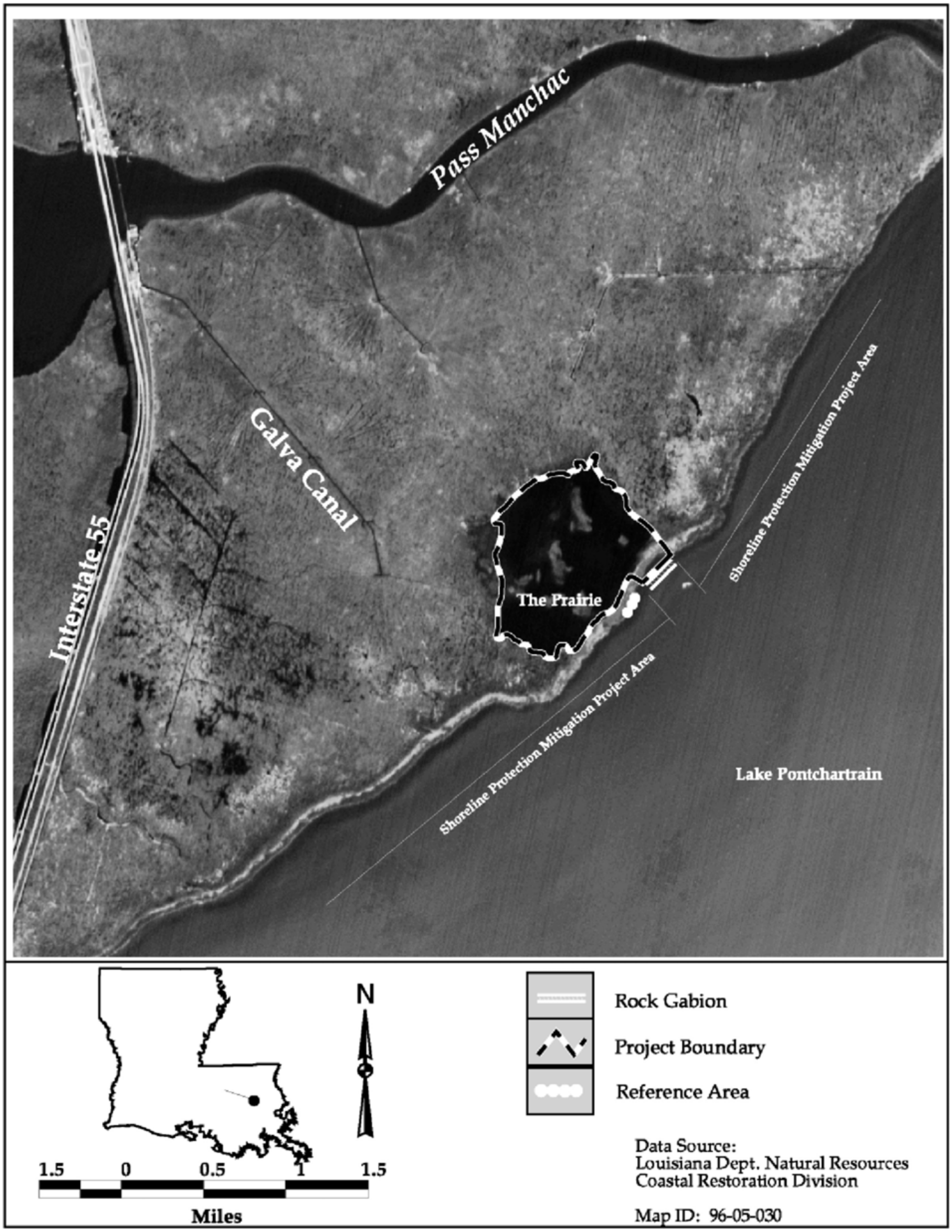

Figure 1. Location of Turtle Cove (PO-10) project and reference areas.

I.2. Project Personnel

Project Phase	Name	Position	Agency
Planning	Kenneth Bahlinger	Project Manager	LDNR
Implementation	George Boddie	Project Engineer	LDNR
Monitoring Mngr.	John Carriere	Monitoring Manager	LDNR
Monitoring Mngr.	Bill Boshart	Monitoring Manager	LDNR

II. PLANNING

II.1. Causes of Loss

What was assumed to be the major cause of land loss in the projected area?
Due to the high wave energies associated with Lake Pontchartrain, the strip of land protecting the Prairie has a shoreline erosion rate of approximately 3.8 m/yr (12.5 ft/yr) (LDOTD 1978). If high wave energies are not attenuated, the shoreline will eventually breach, allowing brackish Lake Pontchartrain waters to enter the Prairie and the surrounding freshwater community.

Shoreline erosion rates were reported as 5.49 m/yr (18 ft/yr) (Savant 1991), 6.10 m/yr (20 ft/yr) (Brown & Root 1992), 4.27 m/yr (14 ft/yr) (LDNR 1991). The entire Lake Pontchartrain has an estimated shoreline erosion rate of 4 m/yr (13.12 ft/yr) (LDOTD 1978).

Erosion was attributed to wind-generated waves resulting from east and southeast winds across the 40.25 – 48.3 km (25-30 mile) fetch of Lake Pontchartrain (Brown & Root 1992).

What were assumed to be the additional causes of land loss in the projected area?
Highly erodable, organic surface soils could be a contributing factor to shoreline erosion, based on information in the Feasibility Report (Brown & Root 1992):

"Soils were dark, soft clays along with coarse organic material commonly called "coffee grounds". There was no evidence of sand in the area. Soils between the 0.6 and 0.9 m (2 and 3 ft) contour (45.7 and 91.5 m [150 and 300 ft] from shore, respectively) were soft, organic clays with silt. Soil color was black, and appeared to be highly plastic. Conversations with a USACE Senior Geologist, New Orleans District, verified that the stratigraphy in the area consists of 1.5 - 3 m (5 - 10 ft) of Holocene surface deposits (medium to highly organic, very soft to soft clays) and Pleistocene clays below 3 m (10 ft) (stiff to very stiff clays)."

II.2. Background

In 1987, a small state-funded effort planted *Phragmites australis* (Roseau cane) and *Spartina alterniflora* (smooth cordgrass) along Lake Pontchartrain in the vicinity of this project to decrease the rate of shoreline erosion with limited success. The planting work was funded through the LDNR/Natural Resources Conservation Service/Soil and Water Conservation Committee Vegetation Planting Program and was not monitored as a part of this project. A concurrent study was also conducted n 1987 to evaluate *S. alterniflora* as an erosion control measure within the project area, however, high wave energy and a fiber mat design flaw resulted in damage to the plants and poor survival (Good 1988).

Subsequently, the USACE had proposed a shoreline protection project along the entire eastern shoreline of the Manchac WMA as a part of a mitigation plan for the Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection Project. This mitigation project called for a series of rock dikes with filter cloth to protect approximately 26,400 ft (8049 m) of shoreline. However, the federal mitigation project was delayed. The area that was selected for the Turtle Cove PO-10 project was the most narrow and vulnerable section of this shoreline (approximately 1000 ft [305 m]), which had only 200 ft (61 m) of land remaining before breaching through into the interior, fragile open-water area known as "The Prairie". This project was proposed as a quick means of protecting the shoreline in this fragile area in light of the uncertain timeline for the mitigation project.

Rock breakwaters have been shown to be effective at protecting shorelines from erosion often associated with high wave energies (Larrick and Chabreck 1978, Peyras et al. 1992, Schollen et al.1995).

II.3. Project Goals and Objectives

How were the goals and objectives for the project determined?
Project goals and objectives were simply adapted from the LDWF plan to protect the fragile segment of shoreline separating "The Prairie" from Lake Pontchartrain in the interim period before the USACE mitigation project could be constructed.

The fact sheet from the FY 1991-1992 Coastal Wetlands Conservation and Restoration Plan (LDNR 1991) indicates that the objective of this project is to protect the highest priority shoreline segment at "The Prairie" until the USACE can institute the mitigation program.

The Monitoring Plan (dated August 9, 1993, revised September 5, 1995; LDNR 1995) identified the Objective and Goal of this project as follows:

Project Objective: Maintain and protect 2,247 ft (685m) of northwest Lake Pontchartrain shoreline which shelters 800 acres (320 ha) of fresh marsh.

Project Goal: Diminish the rate of shoreline erosion at Turtle Cove along the northwest portion of Lake Pontchartrain.

In Monitoring Series Progress Report #1 (Carriere 1995), "The project objectives are to maintain and protect the Lake Pontchartrain shoreline which shelters the prairie from high-wave energies and to encourage sediment deposition into the area behind the gabion breakwater (deposition area). Sediment deposition will be promoted by leaving a gap in the breakwater thereby allowing water exchange with the deposition area."

Are the goals and objectives clearly stated and unambiguous?
Are the goals and objectives attainable?
The Objective and Goal statements are appropriate, clearly stated, realistic and attainable for this project.

Do the goals and objectives reflect the causes of land loss in the project area?
The goals and objectives address the perceived causes of land loss.

III. ENGINEERING

III.1. Design Feature(s)

What construction features were used to address the major cause of land loss in the project area?
A Feasibility Study was completed by Brown & Root in 1992, evaluating eight alternative plans, considering both short-term temporary solutions, and long-term permanent solutions. Long-term erosion control alternatives were designed to interface with the proposed Federal mitigation plan, while short-term alternatives were designed solely to prevent a breach until the proposed Federal mitigation plan is implemented.

Alternatives considered:

Short-term:

- Longard Tubes: two 500-ft (152 m) Longard Tubes filled with sand to be placed 150 ft (46 m) from shore with a 25-ft (7.6 m) overlap in the center with a 10-ft (3 m) gap between the overlapping portions. This plan was recommended by LDWF and was included in the original proposal to CWPPRA. Cost - $280/ft ($918/m). The manufacturer of the Longard Tubes recommended using three 328ft (100m) sections instead of two 500 ft (152 m) sections, bringing the cost down to $120/ft ($394/m).
- 1000 ft (305 m) of brush dike: three rows of 4-inch (10 cm) diameter fence posts on 4-ft (1.2 m) centers. This type of device was used on the north shore of Lake Pontchartrain (Fountainbleu State Park) as a part of the USACE Shoreline Erosion Control Demonstration Program (Section 54) in 1981 with little success.

- 1000 ft (305 m) of sand-cement sill: sand-cement bags wrapped in geotextile fabric to form a sill structure 200 ft (61 m) long with 50-ft (15.2 m) gaps between each sill. This was also used on the north shore of Lake Pontchartrain (Fountainbleu State Park) as a part of the USACE Shoreline Erosion Control Demonstration Program (Section 54) in 1981 with relative success, however it was believed that installation at this site would require the excavation of a flotation channel. In addition, it is of comparable cost to rock, but does not allow for easy modifications/maintenance.
- Timber-pile breakwaters: Timber-pile and tire breakwaters in 200 ft (61 m) segments with 50 ft (15.2 m) gaps. Cost estimate was $75/ft ($246/m) using a single row of piles, and $100/ft ($328/m) with a double row of piles.
- 100 ft (30.5 m) of earthen dike: earthen dikes constructed in 200 ft (61 m) sections with 50 ft (15.2 m) gaps. Three ft high with a crown width of 10 ft (3 m), placed offshore at 2-ft (0.61 m) depth contour. Side slope would be 1:6 due to poor engineering properties of available material. Cost is $47/ft ($154/m), but is the most temporary alternative.
- No protection alternative: Estimated that without any substantial storm events, the shoreline would breach within 10 years.

Long-Term Plans:
- 1000 ft (305 m) of rock dike breakwaters: Rock dikes and filter fabric in 200 ft (61 m) segments with 50 ft (15.2 m) gaps, 3 ft (9 m) in height above the mudline, 5 ft (1.5 m) crown width, side slope of 1:3. Very poor soil conditions may require the use of a light weight core material.
- 5000 ft (1524 m) of rock dike breakwaters: same configuration as previous, but continuing for the entire length "The Prairie". Cost is $151-$154/ft ($495 - $505/m).

Recommended plan was the 1000-ft (305 m) of rock dike breakwaters.

The original plan was submitted by LDWF prior to consideration for funding from the State Trust Fund or CWPPRA, received an USACE permit on permitted on September 12, 1990, and a CUP permit on October 23, 1989. The original permit was for the installation of sand-filled Longard Tubes.

The permits were revised in 1992 to reflect the recommendations of the Feasibility Report (Brown & Root 1992) and a change was made in the project from Longard Tubes to a continuous rock breakwater.

Soil borings collected in June 1992 and subsequent analysis indicated that the soil bearing capacities in the project area were poor.

The permits were again revised in August 1992 based on the geotechnical investigation which revealed that the proposed location (125 ft [38 m] from shore) was too close to allow construction to be completed without dredging access or scouring the lake bottom. The permits were revised to re-locate the structure further (approx. 300 ft [91 m]) from shore.

In November 1992, the permits were again revised to reflect a change from continuous rock breakwater to the gabion structure that was constructed. The change was necessary because of "unstable soils". The gabions are lighter and smaller than the original rock dike. The gabion structure that was constructed was 1,640 ft (500 m) in length at a cost of $351,000 ($214/ft). This structure consisted of geogrid, crushed limestone, gabion structures, and mattresses. The structure is 30 ft (9 m) wide at the base, 4.5 ft (1.4 m) wide X 6 ft (1.8 m) long X 3 ft 0.9 m) tall baskets are placed end-to-end on top of the base mattress in 2.5 ft (0.76 m) Mean High Water.

The USACE has used Gabion mattresses extensively to protect segments of the Mississippi River levee. This is the first application in Louisiana for the purpose of wetland restoration.

What construction features were used to address the additional causes of land loss in the project area?
Nothing was constructed to address the weak, easily erodible soils condition. However, the design feature was altered several times due to the weak soils. In addition, a geotextile fabric, and a 10-12 inch (25.4 – 30.5 cm) thick crushed limestone layer was used as a base on which to construct the gabions.

What kind of data were gathered to engineer the features?
Soil borings were collected: 2-borings to a depth of 50 ft (15.2 m), and 2 borings to a depth of 25 ft (7.6 m). Samples were collected using a rotary drill rigs mounted on a cargo buggy. Samples were subjected to soil mechanics laboratory tests, consisting of natural water content, unit weight, unconfined compression shear, unconsolidated undrained triaxial compression shear, miniature vane shear, and Atterberg liquid and plastic limits (Letter from Eustis Engineering, 30 March 1992).

Site-specific relationships were developed between mattress thickness, unit weight of the gabion fill, dike settlement, dike height after subsurface consolidation, and dike stability against general shear failure (Eustis Engineering, 9 October 1992 letter).

Elevation surveys/ bathymetry, vertical control point (by DNR)

Re-establish USACE monument LPM 13, install 2 reference points, one north, and one south of the project.

What engineering targets were the features trying to achieve?
Top of gabion = +3.00 ft (0.9 m) above mudline after consolidation in plans;
+2.25 ft (0.7 m) as built

III.2. Implementation of Design Feature(s)

Were construction features built as designed? If not, which features were altered and why?

October 1993: Changed/extended gabion from 1000 to 1200 ft (305 – 366 m) to avoid trees and stumps near tie-in point. Additional cost was $7,893.30.

June 1993: Changed from welded gabions to twisted/woven gabions to allow for increased flexibility.

May 12, 1994: Change from woven lacing wire to attach gabions to each other, to stainless steel rings and a gun. The contractor requested this change to make installation easier and to provide for added flexibility of the gabion structure.

May 27, 1994: Change order for an additional 278 cubic yards (206 cubic meters) of rock at a cost of $32/cubic yard ($43/cubic meter). Due to the initial settlement of the gabions below the desired top elevation, it was decided to make the rock mattress thicker than the design thickness, and the contractors ran short on rock.

III.3. Operation and Maintenance

Were structures operated as planned? If not, why not?
No operable structures were constructed.

Are the structures still functioning as designed? If not, why not?
Structure is still functioning as designed. Shoreline erosion has been stopped and some land has accreted.

Was maintenance performed?
After construction in 1996, transplants were taken from the *Phragmites australis* (Roseau cane) stands that were planted in 1987. These transplants were installed in the northern portion of the project area where sediment was accumulating. In addition, *Zizaniopsis mileacea* (Giant cutgrass) was also planted in accreted areas to stabilize new sediments. The planting work was funded through the LDNR/Natural Resources Conservation Service/Soil and Water Conservation Committee Vegetation Planting Program and was not monitored as a part of this project.

Maintenance was performed, but only 6-yrs after construction. PVC coating on gabion cages was rubbed off by moving rock in the gabions and by campfires started on top of the gabions. As a result, the gabions rusted through and started to break open. In addition, settling of the gabion structure has also occurred. Maintenance in the form of capping the structure with rock was performed in 2000 for the cost of $159,700. The original gabion structure was increased by approximately 1.0 ft with the new rock. Approximately 4,050 tons of rock were used to cap the gabion, and an additional 400 tons of rock were used to construct a plug in Fourth Canal, approximately 1.0 mile south of the gabion structure.

IV. PHYSICAL RESPONSE

IV.1. Project Goals

Do monitoring goals and objectives match the project goals and objectives?
In Monitoring Series Progress Report #1 (Carriere 1995), "The project objectives are to maintain and protect the Lake Pontchartrain shoreline which shelters the prairie from high-wave energies and to encourage sediment deposition into the area behind the gabion breakwater (deposition area). Sediment deposition will be promoted by leaving a gap in the breakwater thereby allowing water exchange with the deposition area."

IV.2. Comparison to adjacent and/or healthy marshes

IV.2.1. Elevation

What is the range of elevations that support healthy marshes in the different marsh types?
Relating elevation to a datum was problematic with this project, and no surveys were ever done of the surrounding marsh surface elevation.

Does the project elevation fall within the range for its marsh type?
Project is a shoreline protection project. The material that has accreted behind the rock gabion structure accumulated sufficient material to support emergent vegetation.

Did the project meet its target elevation?
Elevation was not a project goal, however elevation goals were part of the project design criterion.

Elevation of the structure:
"The initial portion of the structure appears to be settling uniformly with initial settlement of 0.4 ft (0.12 m) during the first week." (Letter from Kenneth Bahlinger to Joey Murray, May 25, 1994). "In order to offset the initial consolidation and settlement…increase the thickness of base course by 0.5 ft (0.15 m) to an elevation of 98.2 Mean High Water (MHW)."

From October 1994 to January 1997 there was an average settlement of -0.59 ft + 0.060 s.e. (-0.18 m + 0.018) across the gabion (figure 2). These data indicate that the outside edges of the gabion, settlement plates number 1 and 4, had settled at a slightly faster rate than did the interior. Overall, the rate of settlement had slowed from -0.48 ft/yr (-0.12 m/yr) (October 1994 to March 1995), to -0.23 ft/yr (-0.07 m/yr) (March 1995 to January 1996), to -0.20 ft/yr (-0.06 m/yr) (January 1996 to January 1997). (O'Neil and Snedden 1999).

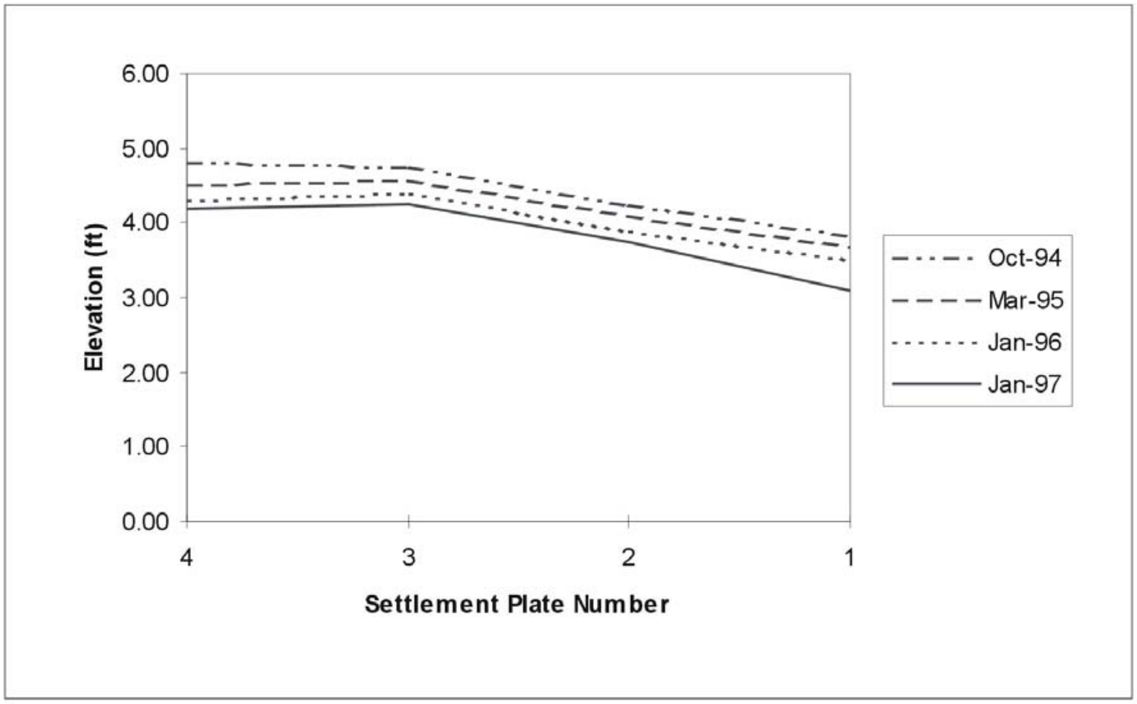

Figure 2. Elevation of the Turtle Cove (PO-10) gabion , October 1994 to January 1997. Settlement plates 1 throu 4 are located from the northeast corner of the structure to the southwest portion of the structure, respectively.

Elevation of the sediment (accretion):
Elevational surveys were completed in January 1996 and January 1997. Mean elevation for January 1996 was -1.43 ft ± 0.10 standard error (s.e. -0.44 m ± 0.03) whereas the average sediment level for January 1997 was -1.17 ft ± 0.13 s.e (-0.36 m ± 0.04). This represents a gain of 0.26 ft (0.08 m) in elevation for the year. A t-test performed on the data indicates a nearly significant difference between dates at an alpha of 0.05 (T=1.54, df=142, *P*=0.0673). Note these elevations were calculated in terms of a nearby USACE benchmark with an assumed elevation of 0.00 ft (0.00 m), and depending on the validity of this assumption, elevations may only be relative and may not be sufficiently accurate for comparisons outside the project area.

What is the subsidence rate and how long will the project remain in the correct elevation range?
Subsidence in the project area is estimated to be 1.1 – 2.0 ft/century (0.3 – 0.6 m/century) (LCWCRTF and WCRA 1999).

IV.2.2. Hydrology

What is the hydrology that supports healthy marshes in the different marsh types?
No information was available on marsh flooding frequency and duration, and this was not a component of this project.

Does the project have the correct hydrology for its marsh type?
NA

What were the hydrology targets for the project and were they met?
NA

IV.2.3. Salinity

What is the salinity regime that supports healthy marshes in the different marsh types?
No information was available on salinity, and this was not a project component.

Does the project have the correct salinity for its marsh type?
NA

What were the salinity targets for the project and were they met?
NA

IV.2.4. Soils

What is the soil type that supports healthy marshes in the different marsh types? Does the project have the correct soil for its marsh type?
No soils information was collected on accreted sediment, or on the adjacent marsh. According to the Louisiana Geologic Survey Geologic Map of Louisiana (1984), this area is classified as Holocene Delta Plain, Fresh Marsh and is described as "Gray to black clay of very high organic content, some peat. Area of active and abandoned delta lobes of the Mississippi River."

IV.2.5. Shoreline Erosion

How have shoreline erosion rates changed in the project area compared to nearby reference areas?
Shoreline Movement:
Shoreline movement was highly variable both temporally and spatially (figure 3). Project/reference comparisons for the only valid time period of December 1995 to December 1996 indicate that median project area shoreline progradation was 3.47 ft/yr (1.05 m/yr), whereas the reference area shoreline retreated 6.3 ft/yr (1.92 m/yr; figure 4). A Kruskal-Wallis test indicated that median project and reference area shoreline movement rates during this time period were significantly different ($\chi 2=6.65$; df=1; P=0.0099). When broken down into approximately six-month

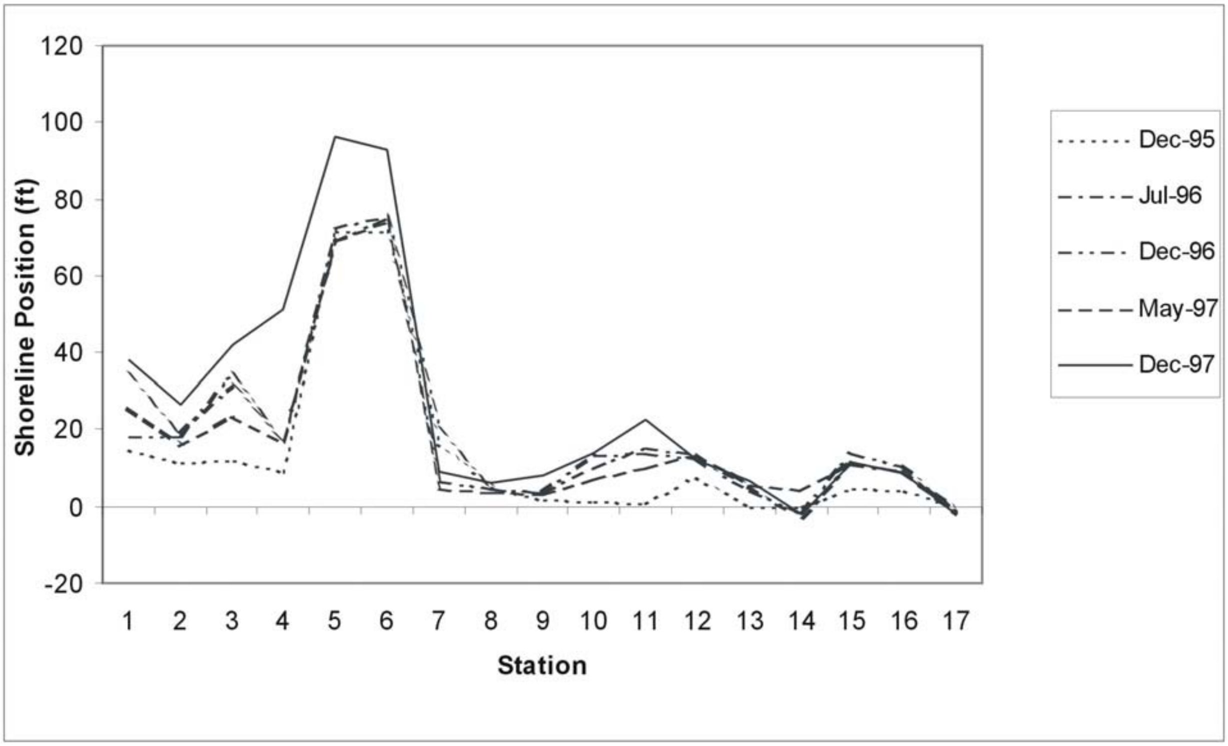

Figure 3. Shoreline positions, by station, from December 1995 to December 1997, relative to the October 1994 shoreline survey. The gap in the gabion is located in the vicinity of stations 4 and 5.

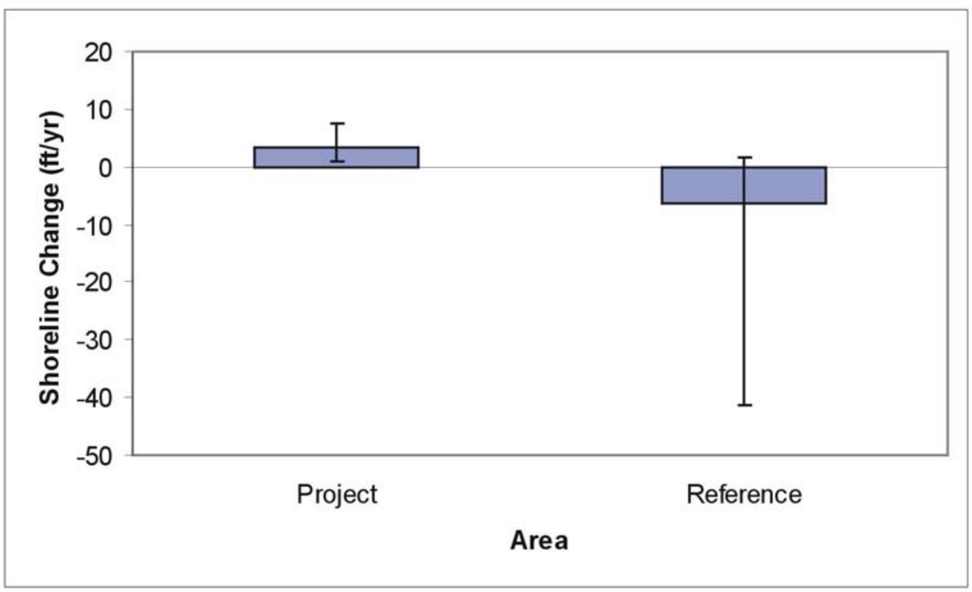

Figure 4. Median shoreline movement rates with 95% confidence intevals for project and reference aras at Turtle Cove (PO-10), December 1995 to December 1996. Positive values represent shoreline advance, negative values indicate shoreline retreat.

segments, it is clear that the greatest difference between the project and reference area occurs during the last half of 1996, when losses occurred for both sites (figure 5).

Spatial variation was evident not only between the project and reference areas, but also within the project area as well. Shoreline position stations were categorized into three groups (lower, middle, and upper) based on their location along the length of the gabion. The six-foot gap in the gabion is located in the lower section of the gabion. A Kruskal-Wallis test indicated that median shoreline movement rates were greatest behind the lower portion of the gabion ($\chi 2$=10.47, df=2, P=0.0053; figure 6).

Median shoreline progradation in the project area from October 1994 to December 1997 was 12.19 ft. (3.71 m), or 3.75 ft/yr (1.14m/yr). Within this time period, median project area shoreline movement differed statistically between individual sampling periods ($\chi 2$=17.41; df=4; P=0.0016). Median shoreline movement from May 1997 to December 1997 was considerably greater than the previous two sampling intervals where losses actually occurred (figure 7). The 1998 shoreline positions obtained in the 1998 GPS survey were superimposed upon the aerial photography taken in November 1994 (when construction was completed). From this analysis, it was determined that 5.78 ac (2.34 ha) of water had been converted to land within the project area (figure 8).

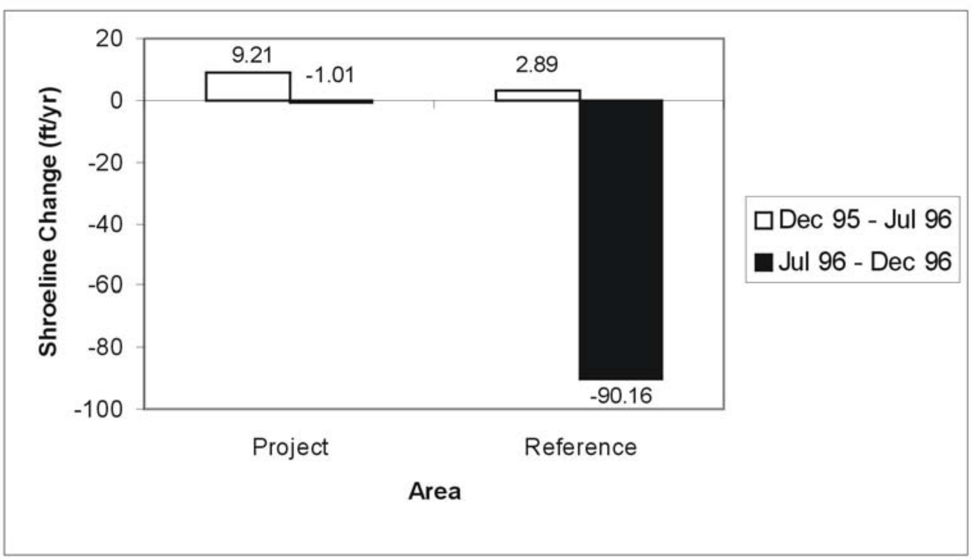

Figure 5. Median shoreline movement rates, by time period, for project and reference areas at Turtle Cove (PO-10) , December 1995 to December 1996. Positive values represent shoreline advance, negative values represent shoreline retreat.

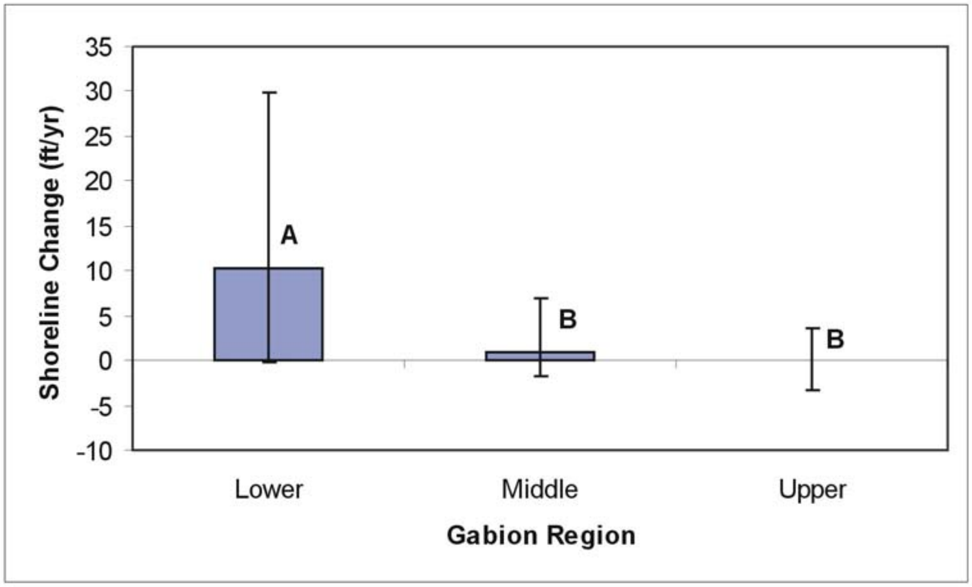

Figure 6. Shoreline change with 95% confidence intervals at Turtle Cove (PO-10). Lower area includes stations 106 and the gap in the gabion. Middle area includes stations 7-11. Upper area includes stations 12-17.

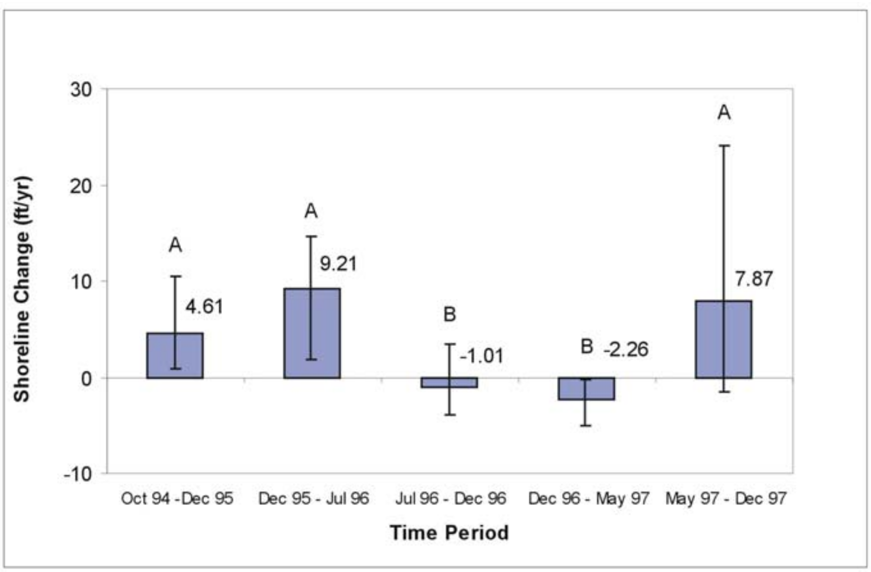

Figure 7. Median shoreline movement rates and 95% confidence intervals for shoreline stations within the Turtle Cove (PO-10) project area by time period.

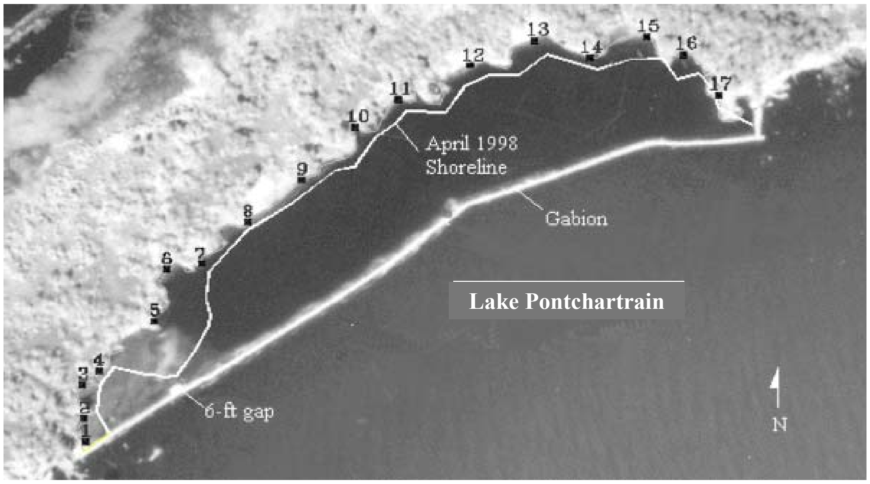

Figure 8. 1998 shoreline data collected using GPS, superimposed on 1994 aerial photography of the Turtle Cove (PO-10) project area shortly after construction.

IV.2.6. Other

While not an objective of this project, it was possible to compare the relative effectiveness of the gabion versus the USACE breakwaters in terms of shoreline protection, as measured through shoreline movement. From December 1996 to December 1997 the project and reference areas were protected by either the gabion or a breakwater, respectively. A Kruskal-Wallis test indicates no statistical difference in shoreline movement among structure types ($\chi 2=1.13$; df=1; P=0.2888).

IV.3. Suggestions for physical response monitoring

Are there other variables that could be monitored to substantially increase the ability to understand the results of the project?
Sediment elevation in front of and behind the gabions would allow evaluation of sediment movement relative to structure.

Monitoring on wave abatement was not conducted, however photographs were taken to illustrate this effectiveness and the additional effort would not have increased the ability to evaluate project effectiveness.

V. BIOLOGICAL RESPONSE

V.1. Project Goals

All of the Monitoring goals were physical.

V.2. Comparison to adjacent and/or healthy marshes

V.2.1. Vegetation

What is the range in species composition and cover for healthy marshes in each type?
Relating elevation to a datum was problematic with this project, and no surveys were ever done of the surrounding marsh surface elevation.

Does the project have the correct species composition and cover for its type?
Vegetation species composition and percent cover were not collected as a part of this projects Monitoring Plan.

What were the vegetation targets for this project and were they met? If not, What is the most likely reason?
No vegetation targets were set, however, "The Prairie" was formerly a *Panicum hemitomum* (maidencane) marsh, but the low salinity tolerance of this species in conjunction with frequent infusion of salinity in the areas has created an expansive, shallow body of water containing an abundance of submerged aquatic vegetation. (USACE 1994). Vegetation species that are established in this area are indicative of fresh/intermediate marsh.

V.2.2. Landscape

What is the range in landscapes that supports healthy marshes in different marsh types?
NA

Is the project changing in the direction of the optimal landscape? If not, what is the most likely reason?
This project has successfully established a stable, prograding shoreline. Sediment that has accumulated between the rock gabion and the shoreline has established an elevation suitable for emergent vegetation.

V.2.3. Other

Describe any other biological characteristics of the project that have bearing on the projects' success
None.

V.3. Suggestions for biological response monitoring

Are there other variables that could be monitored to substantially increase the ability to understand the results of the project?
The goals for this project were physical. No biological goals were stated.

VI. ADAPTIVE MANAGEMENT

VI.1. Existing improvements

What has already been done to improve the project?
This project has performed well and has not needed any adjustment other than a maintenance lift. The coating on the gabion baskets has worn off and the baskets have started to open up after 6 years. Additional rock was placed over the gabion structures as a part of O&M.

VI.2. Project effectiveness

Are we able to determine if the project has performed as planned? If not, why?
This project has worked as planned. The response has been very positive with sediment accreting behind the structures, emergent vegetation becoming established, and shoreline erosion being reversed.

What should be the success criteria for this project?
The success criteria for this project should be the reduction and/or elimination of shoreline erosion as compared to the historical rate of erosion and as compared to the reference area.

VI.3. Recommended improvements

What can be done to improve the project?
No recommendations are being made to improve this project.

VI.4. Lessons learned

This project went through many changes during the design and permitting stages due to findings during geotechnical investigations. Although these changes delayed project construction and required amendments to permits and other red tape, the result was a very successful project without major mid-construction modifications. This project is a good example of a well planned, carefully thought out projects.

Elevations were not tied in prior to construction and as a result, final elevation of the structure was 0.75 ft lower than anticipated. Future projects should have elevation references established and tied into the vertical control network prior to construction.

Well qualified construction inspection and oversight and well qualified contracting officers are essential to ensure that projects are constructed as designed and that problems which occur in the field are handled in the best possible way as to not compromise the goals of the project.

The gabion structure was durable and had a low settlement rate for a highly organic area. This structure type could possibly be used in other areas of the state where shoreline erosion along highly organic shorelines is problematic.

Future investigations are recommended to include relative performance of gabions and adjacent rock breakwaters, in terms of effectiveness and cost.

VII. SUPPORTING DOCUMENTATION

VII.1. Published References

Brown & Root, Inc. 1992. Feasibility Report for Turtle Cove Shore Protection, St. John the Baptist Parish, Louisiana. 49pp.

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VII.2. Unpublished References

Agency	Year (Month)	Agency Contact	Document Type	Short Description	Pages
LDNR	March 30, 1992	Kenneth Bahlinger	Letter	Proposal for geotech services from Lloyd A. Held, Jr. at Eustis Engineering	2
LDNR	October 9, 1992	Kenneth Bahlinger	Letter	Analysis of the gabion stability from Lloyd A. Held, Jr. at Eustis Engineering	4
LDNR	May 25, 1994	Kenneth Bahlinger	Letter	From Kenneth Bahlinger to Joey Murray at Murray and Associates regarding initial consolidation of the structure during construction and design revision to increase mattress thickness on remaining segments.	5

VIII PROJECT REVIEW TEAM

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Loland Broussard (NRCS)
John Troutman (LDNR)
John Foret (NMFS)
Wes McQuiddy (EPA)
Richard Boe (USACE)
George Boddie (LDNR)

APPENDIX A. PROJECT INFORMATION SHEET

Project Name and Number: PO-10 Turtle Cove
Date: March 11, 2002

INFORMATION TYPE	YES	NO	N/A	SOURCE
Fact Sheet	X			Kenneth Bahlinger (DNR)
Project Description	X			Kenneth Bahlinger (DNR)
Project Information Sheet	X			Kenneth Bahlinger (DNR)
Wetland Value Assessment		X	X	No WVA for state projects
Environmental Assessment		X	X	No EA completed
Project Boundary	X			DNR
Planning Data	X			Kenneth Bahlinger (DNR)
Permits	X			Kenneth Bahlinger (DNR)
Landrights				
Cultural Resources				No EA completed
Preliminary Engineering Design				
Geotechnical	X			Gore or Eustis report (DNR)
Engineering Design				
As-built Drawings				
Modeling Output		X	X	
Construction Completion Report		X		
Engineering Data				
Monitoring Plan	X			John Troutman (DNR)
Monitoring Reports	X			John Troutman (DNR)
Supporting Literature	X			See Gore or Eustis report (DNR)
Monitoring Data				Gary Shaffer (SELU?), USACE mitigation proj (Richard Boe)
Operations Plan		X		
Operations Data		X		
Maintenance Plan		X		
Maintenance Data	X			John Hodnett, Kenneth Bahlinger (DNR)
O&M Reports: Annual inspection rpts	X			John Hodnett (DNR)
Other: Maintenance contract	X			John Hodnett (DNR)
Data Needs:				
Shoreline position				
Accretion behind gabion				